COMPACT, CONTROLLED RESISTANCE EXERCISE DEVICE

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ABSTRACT

Spaceflight leads to muscle and bone atrophy. Isoinertial (free-weight) exercises provide a sufficient stimulus to elicit increases in both muscle strength and bone mineral density in Earth-based studies. While exercise equipment is in use on the International Space Station for crewmember health maintenance, current devices are too large to place in a transport vehicle or small spacecraft. Therefore, a portable computer controlled resistance exercise device is being developed that is able to simulate the inertial loading experienced when lifting a mass on Earth. This portable device weighs less than 50 lb and can simulate the resistance of lifting and lowering up to 600 lb of free-weights. The objective is to allow crewmembers to perform resistance exercise with loads capable of maintaining muscle and bone health. The device is reconfigurable and allows for the performance of typical Earth-based free-weight exercises. Forces exerted, volume of work, range of motion, time-under-tension, and speed/ acceleration of movement are recorded and can be remotely monitored to track progress and modify individual protocols based on exercise session data. A performance evaluation will be completed and data will be presented that include ground-reaction force comparisons between the device and free-weight dead-lifts over a spectrum of resistance levels. Movement biomechanics will also be presented.